

### REMARKS

Claims 1-11 and 13-25 are pending in the present application. By the present Communication, no claims have been added, claims 4, 5, and 17-19 have been canceled without prejudice or disclaimer, and claims 1, 6, 20, and 21 have been amended to define Applicant's invention with greater particularity. Support for the amended claims may be found, among others at page 9, lines 16 - 21, page 10, line 13 - page 11, line 13, page 13, lines 9 - 22, Table 1, Table 2, bridging pages 13 and 14, Example 2, at pages 17 - 19, Example 3, at pages 19 - 20, as well as the results presented in Tables 3 and 4 at pages 23-26 of the specification as filed. As such, the amendments do not raise any issues of new matter. Accordingly, upon entry of the present amendment, claims 1-3, 6-11, 13-16, and 20-25 will be under consideration.

### **Rejections under 35 U.S.C. §102**

Applicants respectfully traverse the rejection of claims 1, 17, and 18 under 35 U.S.C. §102(b) as allegedly being anticipated by Sayari, *et al.* (*Chemistry of Materials* 13, p. 3151-3168, September 2001; hereinafter "Sayari"). To anticipate, a single reference must inherently or expressly teach each and every element of claimed invention. *In re Spada*, 15 USPQ2d 1655 (Fed Cir. 1990); and *Verdegaal Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). MPEP § 2131.

The Office Action alleges that Sayari teaches amine-functionalized mesoporous silica by use of an amine-containing swelling agent, and cites to section 3.2 in support thereof. Applicant has canceled claims 17 and 18, thereby rendering the rejection moot as to those claims. Without acquiescing to the reasoning of the Action and in order to further prosecution of the instant application, Applicant has amended claim 1 to limit the claimed adsorbent to one in which the amine groups are covalently attached to the mesoporous silica or organosilica. Applicant respectfully submits that the materials disclosed by Sayari, do not include covalently attached amino groups. Rather in the materials disclosed by Sayari, the amino groups were introduced by the use of an amine-containing swelling agent such that the amine-containing compounds are retained via Van der Waals forces (see, page 9, lines 11 - 15 , of the present application). Thus,

since Sayari fails to disclose an adsorbent in which the amine groups are covalently attached to the mesoporous silica or organosilica, Applicant submits that Sayari fails to teach each and every limitation of the amended claims. Withdrawal of the rejection is respectfully requested.

**Rejections under 35 U.S.C. §103**

Applicants respectfully traverse the rejection of claims 1-6, 8-11, 13-17, and 20-24 under 35 U.S.C. §103(a) as allegedly being unpatentable over Birbara, *et al.* (U.S. Pat. No. 5,876,488; hereinafter, "Birbara") in view of Stein, *et al.* (*Advanced Materials* 12(19) p. 1403-1419, 2000; hereinafter, "Stein"). Applicant has canceled claims 4, 5, and 19, rendering the rejection moot as to those claims.

The recent U.S. Supreme Court decision in the *KSR International v. Teleflex, Inc.* (82 USPQ2d 1385), modified the standard for establishing a *prima facie* case of obviousness. Under the *KSR* rule, three basic criteria are considered. First, some suggestion or motivation to modify a reference or to combine the teachings of multiple references still has to be shown. Second, the combination has to suggest a reasonable expectation of success. Third, the prior art reference or combination has to teach or suggest all of the recited claim limitations. Factors such as the general state of the art and common sense may be considered when determining the feasibility of modifying and/or combining references. Applicants respectfully submit that the criteria for establishing a *prima facie* case of obviousness have not been satisfied.

The Office Action alleges that Birbara teaches a mesoporous material with an amine-functionalized surface for use as a reusable carbon dioxide adsorbent. However, the Office Action admits that Birbara does not teach the use of mesoporous silica. The Office Action therefore relies upon Stein for allegedly teaching that the surface of mesoporous silicas may be functionalized with amines through a known grafting process and that functionalized mesoporous silica is useful as an adsorbent. According to the Office Action, it would have been obvious to a worker skilled in the art to use any porous support fitting the requirements of Birbara ("a porous material with high surface area that is readily functionalizable with useful amines") with a reasonable expectation of success. In the alternative, the Office Action suggests that Stein

indicates that mesoporous silica is particularly useful for its readily tunable pore diameters and that pore diameter has been recognized as a factor in adsorption performance. Based on this, the Office Action asserts that it would have been obvious to one of ordinary skill in the art to use mesoporous silica in Birbara's adsorption device in order to allow fine-tuning of the pore diameter for maximum performance. Applicant respectfully disagrees with the reasoning of the Action.

Although Birbara does teach amine functionalized sorbents, contrary to the Office Action's assertion, the supports used in the sorbents of Birbara are well known to have different characteristics from mesoporous silica. Applicant respectfully submits that the Office Action draws an incorrect conclusion regarding the porous supports fitting the requirements of Birbara. For example, the Office Action suggests that such supports have a "high surface area." However, at column 3, lines 30 - 34, Birbara specifies that "[s]upports which are useful in practicing the invention are high surface area porous supports having a surface area of about 50 m<sup>2</sup>/g to about 1000 m<sup>2</sup>/g." In contrast, the mesoporous silicas used in the present invention are defined as routinely having a surface area of greater than 1000 m<sup>2</sup>/g (see, *e.g.*, page 6, line 25, of the instant application).

In view of the known differences between mesoporous silica and the supports used in Birbara, one of skill in the art would not have had a reasonable expectation that mesoporous silica could be used in a similar manner to produce an amine-functionalize regenerable adsorbent for successful use in an acid gas dry scrubbing process, let alone an adsorbent having a CO<sub>2</sub> adsorption capacity of at least 2.50 cc/g. Although Birbara does contemplate CO<sub>2</sub> adsorption, it was achieved using a different material that could not have allowed one of skill in the art to predict the CO<sub>2</sub> adsorption capacity of an adsorbent comprising surface or framework amine-functionalized mesoporous silica or organosilica.

Furthermore, the disclosure of Stein does not overcome the deficiencies of Birbara. While Stein does disclose amine functionalized mesoporous silica, none of the amine-functionalized materials are disclosed for use as adsorbents. Although there is some discussion of the use of

functionalized mesoporous silica for sorption of organics from aqueous waste streams, the material used in the disclosed process was prepared to include a hydrophobic surface suitable for attracting organic molecules out of an aqueous stream. This process does not provide any information useful to allow one of skill in the art to predict that an amine functionalized adsorbent could be prepared that is capable of CO<sub>2</sub> adsorption or suitable for use in an acid gas dry scrubbing process.

Since Stein fails to cure the fundamental deficiencies identified in Birbara, Applicant respectfully submits that no *prima facie* case for obviousness exists with regard to the amended claims. For these reasons, Applicant respectfully requests that the rejection be withdrawn.

Applicants respectfully traverse the rejection of claims 7, 20, and 25 under 35 U.S.C. §103(a) as allegedly being unpatentable over Stein, as applied to claims 1 and 9 above, and further in view of Sayari. The Office Action alleges that Birbara in view of Stein does not teach functionalization of an organosilica framework. As such, the Office Action relies upon Sayari for allegedly teaching that organosilica provides superior structure control to that of the other mesoporous silicas. The above-discussed comments distinguishing the claimed invention from Birbara in view of Stein apply equally and are incorporated here. In addition, the above-discussed arguments distinguishing the claimed invention from Sayari apply equally and are incorporated here. Applicant respectfully submits none of the cited references teach or suggest a support material including an amine-functionalized framework, as required by the amended claims. While Sayari does include a brief discussion (Section 6, (iii)) of mesoporous silicas with organically modified frameworks, Applicant submits that Sayari fails to include any teaching or suggestion that such frameworks could include an amine, let alone an amine that would be readily accessible within pore volumes, pore surfaces or pore walls. Since Sayari fails to cure the fundamental deficiencies identified in Birbara and Stein, Applicant respectfully submits that no *prima facie* case for obviousness exists with regard to the amended claims. For these reasons, Applicant respectfully requests that the rejection be withdrawn.

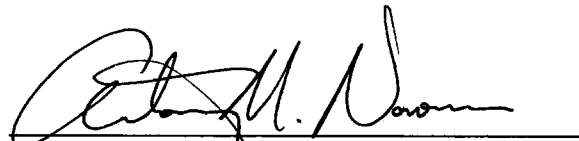
**Conclusion**

In view of the amendments and above remarks, it is submitted that the claims are in condition for allowance, and a notice to that effect is respectfully requested. The Examiner is invited to contact Applicant's undersigned representative if there are any questions relating to this application.

The Commissioner is hereby authorized to charge \$735.00 as payment for the Three-Month Extension of Time fee (\$555) and the Information Disclosure Statement fee (\$180) to Deposit Account No. 07-1896. No other fees are believed to be due in connection with the filing of this paper. However, the Commissioner is hereby authorized to charge any other fees that may be due in connection with the filing of this paper, or credit any overpayment to Deposit Account No. 07-1896.

Respectfully submitted,

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Antony M. Novom, J.D.

Reg. No. 45,517

Telephone No.: (858) 638-6641

Facsimile No.: (858) 677-1465

DLA PIPER LLP (US)  
4365 Executive Drive, Suite 1100  
San Diego, California 92121-2133  
**USPTO CUSTOMER NUMBER 28213**